A Multicoding Theory of Cognitive Semantics

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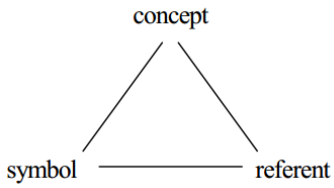
The philosophical problem of meaning. The philosophical problem of meaning is put into new light by the growing interest in artificial intelligence and the following questions gain new relevance. Do symbols need to have meaning? If they do, then what does it mean for them to have meaning? How can symbols refer to objects in the outside world, if the agent doesn't have access to the outside world and only has access to its own sensory perceptions? How can symbols refer to concepts that are not grounded in sensory perception (e.g. abstract concepts such as Hilbert space)? How can an agent judge the truth of various symbolic statements?

Symbol grounding. In cognitive science this is known as the symbol grounding problem. Nagel argued [5] that the nature and quality of subjective meaning and phenomenology is hardly accessible by rigorous scientific methodology. This can be interpreted as saying that the *meaning* of a symbol is private to the interpreter and the connection between the meaning and the symbol is (scientifically) unclear (e.g. meaning of the word "love"). Further, Searle introduced [6] his famous Chinese room argument to show that A.I. which is based solely on symbol manipulation cannot have intrinsic meaning. This argument was further developed by Harnad who compared it to the problem of "Chinese-Chinese dictionary" for someone who doesn't know any Chinese characters [2]. This is when Harnad formulated the symbol grounding problem. The many attempts to solve it include theories of sensory-motor grounding [3], Wittgensteinian language games [7] and statistical symbol covariations [4]. The latter are also critisized on the grounds of the Chinese room problem. It has been argued [1, 8], however, that all the existing approaches make a semantic commitment; that is the designer, or the programmer inputs some meaning into the agent from outside on which the agent builds up the "autonomous" meaning, which is, alas, not autonomous anymore, because it is based on this in-built semantic commitment.

From meaningless to meaningful I would like to argue that the problem of Chinese-Chinese dictionary is not avoidable and instead of avoiding it, one must solve it, i.e. how does meaning emerge from meaningless symbols? Classically, meaning is understood through the semiotic triangle:



Compare this to the situation in classical mathematical logic, where the symbol is a formula in the formal (e.g. first-order) language, referent is the model and concept is the

meaning attached by the mathematician to the formula. But as we argued, there is no referent or concept from the point of view of the agent, at least not before the concept is formed and the meaning is created. There are only information streams coming from different senses, and perhaps being output through various modalities such as motorics. This is the problem not only faced by the philosophers of mind, but also by the programmers when trying to create an autonomous A.I. Intuitively these information streams will more generally correspond to inputs and outputs of individual neurons; inputs coming from different senses such as vision, audition, haptics; Higher level frameworks such as narratives and explanations of various things in different contexts as in "I do not only see the table, but I also know why it is here, what it's social role and how it is produced etc.". Thus, I suggest that the information streams can take any of the three roles in the triangle. Using the classical logic as an illustration, we want our definition to be such that there can be a satisfaction relation $\models$ so that information streams can be put on different sides of it: Each modality is a set M of states φ and a satisfaction relation $\models_M$ which is a relation in the set $\{((M, \varphi), \psi) \mid \psi \in M'\}$ where M' ranges over other modalities.

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